

**CLAIMS**

What is claimed is:

- 1 1. A process for preparing conjugated diene polymers comprising the step of:  
2           polymerizing conjugated diene monomers in the presence of a  
3           catalytically effective amount of a catalyst composition that is formed by  
4           combining:  
5               (a) an iron-containing compound;  
6               (b) a hydrogen phosphite; and  
7               (c) an organoaluminum compound.
- 1 2. The process of claim 1, where the molar ratio of the organoaluminum  
2 compound to the iron-containing compound is from about 1:1 to about 100:1.
- 1 3. The process of claim 2, where the molar ratio of the hydrogen phosphite to  
2 the iron-containing compound is from about 0.5:1 to about 50:1.
- 1 4. The process of claim 1, where the conjugated diene monomers are 1,3-  
2 butadiene, isoprene, 1,3-pentadiene, 1,3-hexadiene, 2,3-dimethyl-1,3-butadiene,  
3 2-ethyl-1,3-butadiene, 2-methyl-1,3-pentadiene, 3-methyl-1,3-pentadiene, 4-  
4 methyl-1,3-pentadiene, 2,4-hexadiene monomers, or mixtures thereof.
- 1 5. The process of claim 4, where the conjugated diene monomers are 1,3-  
2 butadiene monomers.
- 1 6. The process of claim 5, where said step of polymerizing is conducted in the  
2 presence of from about 0.01 to about 2 mmol of the iron-containing compound per  
3 100 g of the 1,3-butadiene.
- 1 7. The process of claim 5, where the molar ratio of the organoaluminum  
2 compound to the iron-containing compound is from about 1:1 to about 100:1.

1       8.     The process of claim 7, where the molar ratio of the organoaluminum  
2     compound to the iron-containing compound is relatively low.

1       9.     The process of claim 7, where the molar ratio of the organoaluminum  
2     compound to the iron-containing compound is relatively high.

1       10.    The process of claim 7, where the molar ratio of the organoaluminum  
2     compound to the iron-containing compound is intermediate.

1       11.    The process of claim 1, where the iron atom in the iron-containing  
2     compound has an oxidation state of 0, +2, +3, or +4.

1       12.    The process of claim 1, where the iron-containing compound is an iron  
2     carboxylate, iron carbamate, iron dithiocarbamate, iron xanthate, iron  
3      $\beta$ -diketonate, iron alkoxide, iron aryloxide, organoiron compound, or a mixture  
4     thereof.

1       13.    The process of claim 1, where the hydrogen phosphite is an acyclic  
2     hydrogen phosphite defined by the following keto-enol tautomeric structures:

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9       or a cyclic hydrogen phosphite defined by the following keto-enol tautomeric  
10    structures:

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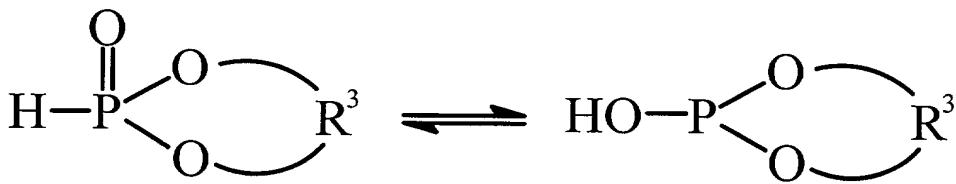
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18 or a mixture thereof, where R<sup>1</sup> and R<sup>2</sup>, which may be the same or different, are  
 19 mono-valent organic groups, and where R<sup>3</sup> is a divalent organic group.

1 14. The process of claim 13, where R<sup>1</sup> and R<sup>2</sup> are alkyl, cycloalkyl, substituted  
 2 cycloalkyl, alkenyl, cycloalkenyl, substituted alkenyl, aryl, allyl, substituted aryl,  
 3 aralkyl, alkaryl, or alkynyl groups, with each group containing up to about 20  
 4 carbon atoms, and where R<sup>3</sup> is an alkylene, cycloalkylene, substituted alkylene,  
 5 substituted cycloalkylene, alkenylene, cycloalkenylene, substituted alkenylene,  
 6 substituted cycloalkenylene, arylene, or substituted arylene group, with each group  
 7 containing up to about 20 carbon atoms.

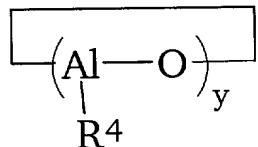
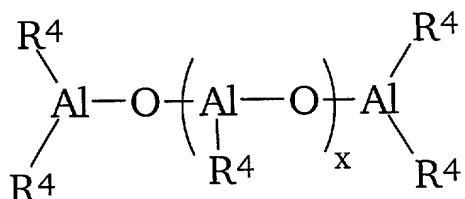
1 15. The process of claim 1, where the organoaluminum compound comprises  
 2 at least one compound defined by the formula AlR<sub>n</sub>X<sub>3-n</sub>, where each R, which may  
 3 be the same or different, is a mono-valent organic group, where each X, which may  
 4 be the same or different, is a hydrogen atom, a carboxylate group, an alkoxide  
 5 group, or an aryloxide group, and where n is an integer including 1, 2 or 3.

1 16. The process of claim 15, where each R is an alkyl, cycloalkyl, substituted  
 2 cycloalkyl, alkenyl, cycloalkenyl, substituted cycloalkenyl, aryl, allyl, substituted  
 3 aryl, aralkyl, alkaryl, or alkynyl group, with each group containing up to about 20  
 4 carbon atoms, and where each X is a carboxylate group, an alkoxide group, or an  
 5 aryloxide group, with each group containing up to about 20 carbon atoms.



1 17. The process of claim 1, where the organoaluminum compound comprises  
2 trihydrocarbylaluminum, dihydrocarbylaluminum hydride, hydrocarbylaluminum  
3 dihydride, dihydrocarbylaluminum carboxylate, hydrocarbylaluminum  
4 bis(carboxylate), dihydrocarbylaluminum alkoxide, hydrocarbylaluminum  
5 dialkoxide, dihydrocarbylaluminum aryloxide, hydrocarbylaluminum diaryloxide,  
6 or mixtures thereof.

18. The process of claim 1, where the organoaluminum compound comprises  
an aluminoxane defined by one of the following formulas:



where x is an integer of 1 to about 100, y is an integer of 2 to about 100, and each R<sup>4</sup>, which may be the same or different, is a mono-valent organic group.

1       19. The process of claim 18, where each R<sup>4</sup> is an alkyl, cycloalkyl, substituted  
2       cycloalkyl, alkenyl, cycloalkenyl, substituted cycloalkenyl, aryl, allyl, substituted  
3       aryl, aralkyl, alkaryl, or alkynyl group, with each group containing up to about 20  
4       carbon atoms.

1 20. A polybutadiene polymer that is prepared by a process comprising the step  
2 of:

3 polymerizing 1,3-butadiene monomer with a catalyst composition  
4 that is formed by combining (a) an iron-containing compound, (b) a  
5 hydrogen phosphite, and (c) an organoaluminum compound.